APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/835,007	04/13/2001	Rudger Rubbert	01-100	3166

			EXAMINER
20306	7590	12/22/2004	CARTER, AARON W

MCDONNELL BOEHNEN HULBERT & BERGHOFF LLP
300 S. WACKER DRIVE
32ND FLOOR
CHICAGO, IL 60606

ART UNIT	PAPER NUMBER
2625	

DATE MAILED: 12/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>26 July 2004</u>.

2a)☐ This action is **FINAL.**   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20 and 33-60* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20,33-36 and 41-60* is/are rejected.

7)☒ Claim(s) *37-40* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 April 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1.   Applicant's election without traverse of claims 1-20 and 33-60 in the reply filed

on July 26, 2004 is acknowledged.

Drawings

2.   The drawings filed on April 13, 2001 are objected to because of draftperson's

remarks (see attached PTO-948).

Specification

3.   Applicant is reminded of the proper language and format for an abstract of the
disclosure.

The abstract should be in narrative form and generally limited to a single
paragraph on a separate sheet within the range of 50 to 150 words. It is important that the
abstract not exceed 150 words in length since the space provided for the abstract on the
computer tape used by the printer is limited. The form and legal phraseology often used
in patent claims, such as "means" and "**said**," should be avoided. The abstract should
describe the disclosure sufficiently to assist readers in deciding whether there is a need
for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given
in the title. It should avoid using phrases which can be implied, such as, "The disclosure
concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

The abstract of the disclosure is objected to because the legal phraseology "said"

is used on multiple occasions. Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 102

4.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5.   Claims 1-5, 7, 9, 13, 14, 18, 19, 33, 36, 42, 43, 46-50, 52-54 and 58-60 are

rejected under 35 U.S.C. 102(e) as being anticipated by USPN 6,476,803 to Zhang et al.

("Zhang").

As to claim 1, Zhang discloses a method of constructing a virtual three-

dimensional model of an object from a scanner (Fig. 1, element 55), a data processing

system (Fig. 1, element 21), and at least one machine-readable memory accessible to said

data processing system (Fig. 1, element 22) comprising the steps of:

(a)   scanning the object with the scanner and thereby obtaining at least two

two-dimensional images of the object, wherein during scanning the scanner and object

are moved relative to each other resulting in each image being taken from a different

position relative to the surface of the object (column 9, lines 12-20);

(b)   processing said data representing said set of images with said data

processing system so as to convert each of said two-dimensional images into a data

representing a frame and thereby generate a set of frames corresponding to said images

(column 10, lines 34-61), said set of frames comprising a cloud of individual points, each

point in each frame expressed as a location in a three-dimensional coordinate system (column 11, lines 11-15);

(c)   storing data representing said set of frames in said memory (Fig. 1, element 22 and column 10, lines 34-61, wherein it is inherent that once the frames are obtained they are stored in memory); and

(d)   further processing said data representing said set of frames with said data processing system so as to register said frames relative to each other to thereby produce a three-dimensional virtual model of the object substantially consistent with all of said frames (column 12, lines 15-34).

As to claim 2, Zhang discloses the method of claim 1, wherein step (d) comprises the step of performing a frame to frame registration of said set of frames, wherein each frame is registered with respect to one other frame in said set of frames (column 12, lines 15-25).

As to claim 3, Zhang discloses the method of claim 1, wherein step (d) comprises the step of performing a cumulative registration of said set of frames, wherein at least some of said frames are registered to a plurality of other frames previously having been registered to other frames in said set of frames (column 12, lines 15-25).

As to claim 4, Zhang discloses the method of claim 1, wherein step (d) comprises performing a frame to frame registration of said set of frames, wherein each frame is registered with respect to one other frame in said set of frames, and thereafter performing

a cumulative registration of said frames wherein at least some of said frames are registered to a plurality of other frames previously having been registered to other frames in said set of frames (column 12, lines 15-25).

As to claim 5, Zhang discloses the method of claim 1, wherein step (d) one of said frames is a starting frame for registration, and wherein a spatial transformation relationship is derived for each of the other frames in said set of frames and stored in said memory, said spatial transformation relationship indicating how the points in said frame should be translated and rotated in a three-dimensional coordinate system to register said frames relative to said starting frame (column 12, lines 22-25).

As to claim 7, Zhang discloses the method of claim 5, wherein said starting frame corresponds to selected image taken of the object and in which other images were taken of the object in the same vicinity of the object such that a substantial amount of overlap exists between said selected image and said other images (column 12, lines 22-25, wherein common coordinate frame corresponds to starting frame).

As to claim 9, Zhang discloses the method of claim 1, wherein said scanner comprises a hand-held scanning device and said object is scanned by moving said hand-held scanning device over said object (column 10, lines 1-8, wherein desktop digital camera corresponds to hand-held scanning device).

As to claim 13, Zhang discloses the method of claim 1, wherein said data processing system is incorporated into a workstation for said scanner (Fig. 1, elements 21 and 55).

As to claim 14, Zhang discloses the method of claim 1, wherein said data processing system comprises a general purpose computer operatively connected to said scanner and said memory (Fig. 1).

As to claim 18, Zhang discloses the method of claim 1, wherein said scanner, said memory and said data processing system are housed in a single unit (Fig. 1).

As to claim 19, Zhang discloses the method of claim 1, wherein said data processing system is coupled to a user interface including a display, and wherein data processing system is operative to display said virtual three dimensional model on said display (Fig 1, element 47 and Figs. 15 and 16).

As to claim 33, please refer to the rejections made for claim 1 above.

As to claim 36, please refer to the rejections made for claim 2 above.

As to claim 42, please refer to the rejections made for claim 9 above.

As to claim 43, please refer to the rejections made for claim 1 above.

As to claim 46, please refer to the rejections made for claim 1 above.

As to claim 47, please refer to the rejections made for claim 2 above.

As to claim 48, please refer to the rejections made for claim 3 above.

As to claim 49, please refer to the rejections made for claim 4 above.

As to claim 50, please refer to the rejections made for claim 5 above.

As to claim 52, please refer to the rejections made for claim 7 above.

As to claim 54, please refer to the rejections made for claim 9 above.

As to claim 58, please refer to the rejections made for claim 13 above.

As to claim 59, please refer to the rejections made for claim 14 above.

As to claim 60, please refer to the rejections made for claim 19 above.

Claim Rejections - 35 USC § 103

6.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

7.   Claims 6 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Zhang.

As to claim 6, Zhang discloses the method of claim 5.

Zhang does not disclose expressly wherein said starting frame corresponds to the

first image captured by said scanner.

At the time of the invention, it would have been obvious to a person of ordinary

skill in the art to begin the registration process with the first image captured by the

scanner. Applicant has not disclosed that starting with the first image captured by the

scanner provides an advantage, is used for a particular purpose or solves a stated problem.

Therefore, it would have been obvious to one of ordinary skill in this art to modify Zhang by starting registration with the first image captured by the scanner to obtain the invention as specified in claim 6.

As to claim 51, please refer the rejections made for claim 6 above.

8.   Claims 8 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of USPN 6,078,701 to Hsu et al. ("Hsu").

As to claim 8, Zhang discloses the method of claim 1.

Zhang does not disclose expressly wherein, in step (d), said set of frames are registered to each other in a sequential order with the order determined, at least in part, upon the degree of overlap in coverage of said object in said frames.

Hsu discloses a process of registering image frames wherein a set of frames are registered to each other in a sequential order with the order determined, at least in part, upon the degree of overlap in coverage of said object in said frames (column 2, lines 48-52 and column 2, line 66 -- column 3, line 5).

Zhang & Hsu are combinable because they are from art of image processing and more specifically image registration.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to register the 3D frames disclosed by Zhang in a sequential order with the

order determined, at least in part, upon the degree of overlap in coverage of said object in said frames as taught by Hsu.

The suggestion/motivation for doing so would have been that the process taught by Hsu provides a reduction in registration error by fully recognizing complete topology of neighborhood relationships (column 2, lines 31-34).

Therefore, it would have been obvious to combine Zhang with Hsu to obtain the invention as specified in claim 8.

As to claim 53, please refer the rejections made for claim 8 above.

9.   Claims 10-12, 20, 41 and 55-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of USPN 5,257,203 to Riley et al. ("Riley").

As to claims 10 and 12, Zhang discloses the method of claim 9.

Zhang does not disclose expressly wherein said object comprises a human.

Riley discloses a method of constructing a 3-D model of an object comprising a human (column 1, lines 17-21 and 29-35).

Zhang & Riley are combinable because they are from the same art of constructing 3-D models.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the method of constructing a 3-D model of objects, disclosed by Zhang, comprising of humans as taught by Riley.

The suggestion/motivation for doing so would have been to provide an improved process of creating human body restoration products (column 2, lines 45-49).

Therefore, it would have been obvious to combine Zhang with Riley to obtain the invention as specified in claims 10 and 12.

As to claim 11, the combination of Zhang and Riley disclose the method of claim 10, wherein said object comprises teeth and associated anatomical structures (Riley, column 1, line 31).

As to claim 20, the combination of Zhang and Riley discloses an orthodontic scanning system performing the method of any of claims 1-19 (Riley, column 8, lines 36-60).

As to claim 41, please refer the rejections made for claim 20 above.

As to claim 55, please refer the rejections made for claim 10 above.

As to claim 56, please refer the rejections made for claim 11 above.

As to claim 57, please refer the rejections made for claim 12 above.

10.   Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of US Patent Application Pub. 2001/0043738 to Sawhney et al. ("Sawhney").

As to claim 15, Zhang discloses the method of claim 1, comprising two independent processors (Fig. 1, elements 21 and 49).

Zhang does not disclose expressly wherein said data processing system comprises at least two independent processors sharing the processing required by steps (c) and (d).

However Sawhney discloses an image processing system that comprises at least two independent processors sharing the processing required by multiple steps (paragraph 0057).

Zhang & Sawhney are combinable because they are from the same art of image processing.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use two independent processors as taught by Sawhney for sharing the processing required by steps (c) and (d) as disclosed by Zhang.

The suggestion/motivation for doing so would have been that using parallel processors increase processing speed (Sawhney, paragraph 0057, lines 14-16).

Therefore, it would have been obvious to combine Zhang with Sawhney to obtain the invention as specified in claim 15.

As to claim 16, the combination of Zhang and Sawhney disclose the method of claim 15, wherein one of said processor is incorporated into a work station for said scanner and wherein the other processors comprises a computer remote from said work station (Zhang, Fig. 1, elements 21 and 49).

11.   Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang and Sawhney in view of Riley.

As to claim 17, the combination of Zhang and Sawhney discloses the method of claim 16.

The combination of Zhang and Sawhney does not disclose expressly wherein said object comprises teeth or that the workstation, scanner and computer remote from the workstation are in an orthodontic clinic.

Riley discloses discloses constructing a 3D model of teeth inherently in an orthodontic clinic (column 1, line 31 and column 8, lines 36-60).

Zhang, Sawhney & Riley are combinable because they are from same art of image processing.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the method for constructing a 3D model as disclosed by the combination of Zhang and Sawhney in an orthodontic clinic as taught by Riley.

The suggestion/motivation for doing so would have been to provide an improved process of creating teeth restoration products (Riley, column 2, lines 45-49).

Therefore, it would have been obvious to combine Zhang and Sawhney with Riley to obtain the invention as specified in claim 17.

12.   Claims 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of USPN 6,434,265 to Xiong et al. ("Xiong") (already of record).

As to claim 34, Zhang discloses the method of claim 33.

Zhang does not disclose expressly wherein step d) comprises the steps of:

1. displaying on a monitor each of said segments

2. prompting a user to select with a user interface device a location on each of said segments which overlaps at least one other segment;

3. storing said locations selected by said user; and

4. using said stored locations as a starting point for registering said segments relative to each other.

However Xiong discloses a method of constructing a virtual 3D model comprising the steps of:

1. displaying on a monitor each of said segments (Fig. 2, element 218);

2. prompting a user to select with a user interface device a location on each of said segments which overlaps at least one other segment (column 17, lines 25-31);

3. storing said locations selected by said user (Fig. 2 and column 17, lines 25-31 wherein it is inherent that the locations are stored in memory); and

4. using said stored locations as a starting point for registering said segments relative to each other (column 17, lines 25-31).

Zhang & Xiong are combinable because they are from the same art of image processing and more specifically image registration.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to add the user interface as taught by Xiong to the method of constructing a virtual 3D model disclosed by Zhang.

The suggestion/motivation for doing so would have been that the user interface can steer the system to produce a more satisfactory panorama (Xiong, column 17, lines 12-14).

Therefore, it would have been obvious to combine Zhang with Xiong to obtain the invention as specified in claim 34.

As to claim 35, the combination of Zhang and Xiong disclose the method of claim 34, further comprising the step of displaying on said monitor the virtual 3-D model (Xiong, column 4, lines 40-49).

13.   Claims 44 and 45 rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of US Patent Publication 2003/0169913 to Kopelman et al. ("Kopelman").

As to claim 44, Zhang discloses the method of claim 43.

Zhang does not disclose expressly wherein said at least two digital three-dimensional frames are obtained from a CT scanner.

Kopelman discloses a method of constructing a virtual 3-D model obtained from a CT scanner (paragraph 0019, lines 15-19).

Zhang & Kopelman are combinable because they are from the same field of 3-D modeling and analysis.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a CT scanner in frames in the method of constructing a virtual 3-D model as disclosed by Zhang.

The suggestion/motivation for doing so would have been the advantage of having a method whereby information which can be acquired from one type of image can be transferred or superpositioned to information available from another type of image (Kopelman, paragraph 0005).

Therefore, it would have been obvious to combine Zhang with Kopelman to obtain the invention as specified in claim 44.

As to claim 45, the combination of Zhang and Kopelman disclose the method of

claim 43, wherein said at least two digital 3-D frames are obtained fro a MRT scanner

(Kopelman, paragraph 0019, lines 15-19).

Allowable Subject Matter

14.   Claims 37-40 are objected to as being dependent upon a rejected base claim, but

would be allowable if rewritten in independent form including all of the limitations of the

base claim and any intervening claims.

Conclusion

15.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure.

USPN 6,621,491 to Baumrind et al. discloses a method of constructing a virtual

3D model.

USPN 5,649,032 to Burt et al. discloses a method of constructing a virtual 3D

model.

US Patent Application Pub. 2003/0039389 to Jones et al. discloses a method of

constructing a virtual 3D model.

16.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Aaron W Carter whose telephone number is (703) 306-

4060. The examiner can normally be reached on 7am - 3:30 am (Mon. - Fri.).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Bhavesh Mehta can be reached on (703) 308-5246. The fax phone number

for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status

information for unpublished applications is available through Private PAIR only. For

more information about the PAIR system, see http://pair-direct.uspto.gov. Should you

have questions on access to the Private PAIR system, contact the Electronic Business

Center (EBC) at 866-217-9197 (toll-free).

awc

BHAVESH M. MEHTA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600